REMARKS

The present Response is submitted in reply to the Office Action of March 21, 2005.

The Examiner has also pointed out that Fig. 1 should be designated as illustrating the prior art as Fig. 1 shows only old art.

In response, the Applicant has amended Fig. 1 in accordance with the attached Submission and Letter to the Official Draftsman to overcome the informality noted by the Examiner with respect to Fig. 1. New formal drawings, incorporating the requested amendments, will follow once the requested drawing amendments are approved by the Examiner. If any further amendment to the drawings of this application is believed necessary, the Examiner is invited to contact the undersigned representative of the Applicant to discuss the same.

Claims 1-7 are presently pending in the Application and, as will be discussed below, the Examiner has rejected claims 1-3, 6 and 7 and has objected to claims 4 and 5.

Claim 1 is rejected, under 35 U.S.C. § 102(b), as being anticipated by U.S. Patent No. 4,618,022 to Hayashi for a POWER TRANSFER DEVICE FOR FOUR-WHEEL DRIVE VEHICLE, hereafter referred to as "Hayashi `022". The Applicant acknowledges and respectfully traverses the raised anticipatory rejection in view of the following remarks.

First considering the present invention as recited in claim 1, the present invention is directed to a drive train for a four wheel drive vehicle wherein the drive train includes a prime mover powering a transmission providing drive power to a front drive train and rear drive train. The front drive train includes a front transaxle driveably connected to the transmission with a first differential device located between the front wheels and the rear drive train includes a rear axle driveably connected to the transmission by a rear drive shaft with a second differential device connected between the rear wheels.

According to the present invention as recited in claim 1, the drive train further includes a continuously variable coupling, such as a continuously variable transmission (CVT), that is situated in the drive train so as to provide a continuously variable non-slip power transmission

between the front and rear drive trains, that is, a non-slipping power transmission at a continuously variable desired ratio between the front and rear drive trains, thereby permitting a difference between a front wheel rotation speed and a rear wheel rotation speed.

To emphasize an essential aspect of the present invention, the front and rear drive trains are connected together and from the prime mover through a continuously variable coupling, such as a continuously variable transmission (CVT). According to the present invention, such a continuously variable coupling distributes power between the front and rear drive trains in a manner that both allows a continuously variable transmission ratio between the front and rear drive trains and that is non-slipping. By contrast, and as discussed in the background of the invention, the front/rear transmissions of four wheel drive systems of the prior art either employ geared or differential transmissions, which allow only a restricted set of fixed transmission ratios or hydrostatic or hydraulic assemblies, which are inherently inefficient because of slip in the units.

Hayashi `022 describes a power transfer device for distributing power between the front and rear drive trains of a four wheel drive vehicle wherein the power transfer device is comprised of first pinion gear type differential and a second carrier type differential and a selector mechanism whereby the front and rear drive trains may each be selectively connected to one of a first and a second output shaft or the carrier of the second differential.

It is, therefore, apparent that the drive train of the present invention as recited in claim 1 is fundamentally distinguished over the Hayashi `022 power transfer device by being a continuously variable coupling, such as a CVT, providing a continuously variable ratio between the front and rear drive trains and allowing a continuously variable range of front/rear transmission ratios. In basic contrast from the variable coupling of the present invention, the Hayashi `022 power transfer device is comprised solely of fixed gear ratio differentials and, as such, the Hayashi `022 power transfer device can provide only a limited set of fixed gear ratios between the front and rear drive trains. It will also be apparent that the Hayashi `022 power transfer device cannot be adapted to provide a continuously variable range of front/rear

ratios as, by its very nature, it contains and can contain only a fixed set of gear ratios, so that the Hayashi `022 a power transfer device cannot and does not even suggest the present invention and is, in fact, completely unrelated to the present invention.

It should be further noted that the Applicant has amended claim 1 to further emphasize this fundamental distinction between the present invention and the teachings of Hayashi `022 and it is the Applicant's belief that the present invention as recited in claim 1 if fully and patentably distinguished over and from the teachings and suggestions of Hayashi `022 under the requirement and provisions of both 35 U.S.C. § 102 and 35 U.S.C. § 103. The Applicant, therefore, respectfully requests that the Examiner reconsider and withdraw the rejection of claim 1, and the allowance of claim 1 as presented herein above.

Claims 1, 2, 6 and 7 are rejected, under 35 U.S.C. § 102(e), as being anticipated by U.S. Patent Publication No. 2003/0079928 for a RUNNING POWER TRANSMISSION MECHANISM FOR A VEHICLE, hereafter referred to as " Hasegawa `928". The Applicant acknowledges and respectfully traverses the raised anticipatory rejection in view of the following remarks.

The recitations of claim 1 have been discussed above and dependent claim 2 adds the further recitations that the continuously variable coupling, that is, the continuously variable transmission, is located in the rear drive train. As described in the specification, this claim refers those implementations of the invention wherein the continuously variable transmission is located generally within or adjacent to the rear differential, which is located between the rear axles and is connected from the rear drive shaft. As such, claim 2 incorporates all recitations and limitations of claim 1 by dependence therefrom.

Claims 6 and 7 are essentially similar and parallel to claim 1, and essentially include the same recitations and limitations as claim 1, but further recite the use of a side shaft from the continuously variable transmission to provide power to the rear drive train.

Therefore considering the teachings of Hasegawa `928, Hasegawa `928 describes a transmission system for a vehicle having steering (front) wheels and steered (rear) wheels

wherein the system includes a continuous main transmission, which may include an electric, hydraulic of CVT transmission, and a hydraulic/differential unit connected between the main transmission whereby, in both two wheel and four wheel drive, the power delivered to the steering (front) wheels is varied by adjusting power through the hydraulic/differential unit to the steering (front) wheels according to a coupling to the steering wheel representing the desired turning radius of the vehicle.

Hasegawa `928 thereby teaches the use of a continuously variable transmission only with respect to the use of a CVT or hydraulic or electrical transmission as a main transmission, and not with respect to the actual differential distribution of power among the vehicle wheels. Hasegawa `928 instead and teaches the use of a second hydraulic/differential transmission, connected from the main transmission, for controlling the actual differential distribution of power to the wheels dependent upon vehicle turning radius. Even in this respect, however, the Hasegawa `928 system varies the distribution of power only respect to the front (steering) wheels, and not with respect to distribution of power between the front and rear wheels.

It is, therefore, apparent that there are a number of fundamental distinctions between the present invention and the teachings of Hasegawa `928. First, and as stated above, Hasegawa `928 uses a CVT or hydraulic or electrical transmission only as a main transmission, and even then only to provide continuously variable power to the second transmission that actually distributes the power among the wheels and in order to make operation of the second transmission easier. In this regard, it must be noted that, in contrast from the present invention, the continuously variable transmission does not and cannot control the distribution of power between the front and rear wheels because the differential distribution of power is controlled solely by the second hydraulic differential transmission, which controls power only to the front (steering) wheels and has no control over the power to the rear (steered) wheels.

In addition, and in further fundamental distinction between Hasegawa `928 and the present invention, it must be noted that in Hasegawa `928 the differential distribution of power is accomplished through a hydraulically based transmission, which by its inherent nature incurs

slip through the transmission and which appears to be a desirable characteristic in the Hasegawa `928 system. As described, however, one of the primary features of the transmission system of the present invention is that the differential distribution of power is not only between the front and rear wheels, and not to the front wheels alone, but is by means of a non-slipping CVT transmission, thereby providing a significantly more efficient transmission.

It is, therefore, the belief of the Applicant that the present invention as recited in claims 1, 2, 6 and 7 is fully and patentably distinguished over and from the teachings and suggestions of Hasegawa `928 under the requirements and provisions of both 35 U.S.C. § 102 and 35 U.S.C. § 103. In this regard, it will be noted that the Applicant has amended claims 1, 6 and 7 herein above to more explicitly delineate the above discussed fundamental distinctions between the present invention and Hasegawa `928. The Applicant, therefore, respectfully requests that the Examiner reconsider and withdraw the rejections of claims 1, 2, 6 and 7, and the allowance of claims 1, 2, 6 and 7 as amended herein.

Next, the Examiner has rejected claim 3 under 35 U.S.C. § 103(a) as being unpatentable over Hasegawa `928 in view of U.S. Patent No. 5,916,053 to McCarrick et al. for DUAL MODE OPERATION CONTINUOUSLY VARIABLE TRANSMISSION HAVING CREEPER AND REVERSE GEARS, hereafter referred to as "McCarrick et al. `053". The Applicant acknowledges and respectfully traverses the raised obviousness rejection in view of the following remarks.

Claim 3 is dependent from claim 2, which is dependent from claim 1, so that claim 3 inherits all recitations and limitations of claims 1 and 2 by dependency therefrom.

Hasegawa `928 has been discussed above and it is the Applicant's position that claim 3 is fully and patentably distinguished over and from the teachings of Hasegawa `928 for the reasons discussed above with regard to claim 1, the recitations and limitations of which are incorporated into claim 3 by dependence. Stated briefly, Hasegawa `928 uses a CVT or hydraulic or electrical transmission only as a main transmission, and even then only to provide continuously variable power to the second transmission that actually distributes the power

among the wheels. Therefore, in Hasegawa `928 and in contrast from the present invention, the continuously variable transmission does not and cannot control the distribution of power between the front and rear wheels because the differential distribution of power is controlled solely by the second hydraulic differential transmission, which controls power only to the front (steering) wheels and has no control over the power to the rear (steered) wheels. In addition, in Hasegawa `928 the differential distribution of power is accomplished through a hydraulically based transmission, which by its inherent nature incurs slip through the transmission and which appears to be a desirable characteristic in the Hasegawa `928 system. As described, however, one of the primary features of the transmission system of the present invention is that the differential distribution of power is not only between the front and rear wheels, and not to the front wheels alone, but is by means of a non-slipping CVT transmission, thereby providing a significantly more efficient transmission.

As discussed above, therefore, and as a result of the recitations and limitations of claim 1 incorporated into claim 3, and for other reasons, the teachings of Hasegawa `928 are not relevant to the present invention as recited in claim 3 under the requirements and provisions of either of 35 U.S.C. § 102 or 35 U.S.C. § 103.

Therefore next considering McCarrick et al. `053, describes a transmission system driving the front and rear axles of a vehicle wherein the engine output is connected an input axle driving an sheave of a continually variable drive mechanism, that is, a continuously variable transmission, and the output sheave of the continuously variable drive mechanism is connected to an intermediate shaft that drives the front axle through a clutch.. According to McCarrick et al. `053, in a basic mode of operation (a) the rear axle is connected by means of a drive chain and sprockets to the intermediate axle output of the continuously variable drive mechanism that also drives the front axle, thereby providing a continuously variable drive output to the rear axle in the same manner as to the front axle, but with a fixed gear ratio, determined by the sprockets, between the front and rear axles.

In addition, however, McCarrick et al. `053 includes a mechanism comprised of planetary, pinion and sun gears and clutches, including transfer clutches, that allows the transmission to also operate in two additional modes. For example, and as discussed, in mode (a) the mechanism allows the drive shaft to the rear axle to be connected to the fixed ratio output from the front axle shaft through the sprockets and drive chain mechanism. In a second mode, which may be designated as a mode (b), the shaft to the read axle is connected directly to the engine output for a low, creeper gear drive ratio, and in a third mode, which may be designated as a mode (c) the shaft to the rear axle connected to a reverse drive mechanism comprised of the planetary and sun gears and transfer clutches.

According to McCarrick et al. `053, the purpose of modes (b) and (c) is to bypass or cut out the continuously variable drive at low or creeper speed gear ratios and for the reverse gear, which is a low gear ratio, and to switch to the continuously variable drive at higher speeds. This arrangement provides fixed gear ratios but at greater torque levels at lower speeds, but continuously variable gear ratios at higher speeds, thereby providing the best characteristics of both fixed gear ratio transmissions and continuously variable gear ratio transmissions.

It is, therefore, the Applicant's position that the present invention as recited in claim 3, which incorporates the recitations of claims 1 and 2 by dependence, is fully and patentably distinguished over and from McCarrick et al. `053 for a number of fundamental reasons.

For example, in the basic mode of operation, that is, in mode (a), the rear axle is connected to the intermediate axle output of the continuously variable drive mechanism by a fixed gear ratio determined by the drive chain sprockets that also drives the front axle. Therefore, and while this mode provides a continuously variable gear ratio output to both the front and rear axles, the gear ratio between the front and rear axles is fixed, as the ratio determined by the gear sprockets, so that when operating in mode (a), and in complete contrast from the present invention, the McCarrick et al. `053 mechanism cannot and does not vary the distribution of power between the front and rear axle assemblies. Stated another way, and in fundamental contrast from the present invention, in the McCarrick et al. `053 mechanism the

continuously variable transmission does not and cannot variably distribute power or speed between the front and rear wheels of the vehicle. Instead, the distribution of power and speed between the front and rear wheels is fixed, by the ratio of the sprockets in the chain drive connection, and the continuously variable transmission unit serves only to determine the overall speed or power delivered to the combination of the front and rear wheels.

Further in this regard, in modes (b) and (c) the continuously variable drove mechanism is bypassed so that the rear axle is driven directly from the engine output or through the reverse gear assembly. As such, the continuously variable drive mechanism is not engaged in driving the rear axle at all and thereby neither distributes speed or power between the front and rear wheels nor provides even a variable speed output to the rear wheels.

It is, therefore, the Applicant's belief that McCarrick et al. `053 does not teach or suggest the present invention as recited in claim 3, which includes the recitations of claims 1 and 2 by dependence therefrom, under the requirements and provisions of either of 35 U.S.C. § 102 or 35 U.S.C. § 103.

Therefore considering the combination of Hasegawa `928 in view of McCarrick et al. `053, it must first be noted that neither Hasegawa `928 nor McCarrick et al. `053 teaches or suggests essential elements of the present invention as recited in claim 1 and therefore as recited in claim 3. For example, neither Hasegawa `928 nor McCarrick et al. `053 teach or suggest the use of a continuously variable coupling or transmission to distribute power between the front and rear wheels in a continuously variable manner. If neither neither Hasegawa `928 nor McCarrick et al. `053 teaches or suggests the use of a continuously variable coupling or transmission to distribute power between the front and rear wheels in a continuously variable manner, then there is no combination of Hasegawa `928 and McCarrick et al. `053 that can or does teach or suggest this aspect of the present invention.

In fact, the most that could be taught by a combination of Hasegawa `928 in view of McCarrick et al. `053 is the addition of the McCarrick et al. `053 reverse/low gear bypass to the

hydrostatic main transmission of Hasegawa `928, which would not result in any teaching or suggestion relevant to the present invention under either of 35 U.S.C. § 102 or 35 U.S.C. § 103. It should also be noted in this regard, that McCarrick et al. `053 does not even add the teaching of the use of a continuously variable transmission to the Hasegawa `928 system as Hasegawa `928 already suggests that a continuously variable transmission could be used for certain functions in the Hasegawa `928 system, although, as discussed above, without teaching or suggesting the present invention.

It is therefore the Applicant's belief that Hasegawa `928 in view of McCarrick et al. `053 does not and cannot teach or suggest the present invention as recited in claim 3, and as recited in parent claim 1, to those of ordinary skill in the arts under the requirements and provisions of either of 35 U.S.C. § 102 or 35 U.S.C. § 103. The Applicant, therefore, respectfully requests that the Examiner reconsider and withdraw the rejection of claim 3, and the allowance of claim 3 as amended herein above by the amendment of claim 1.

Lastly considering claims 4 and 5, the Applicant thanks the Examiner for indicating that claims 4 and 5 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form to include all of the limitations of the base claim and any intervening claims. In accordance with this indication, the Applicant has appropriately amended claim 4 to be an independent claim incorporating all recitations and limitations of base claim 1 and intervening dependent claims 2 and 3, so that claim 4 is now believed to be allowable. It is noted that claim 5 is dependent from claim 4 and is thereby now dependent from an allowable claim, so that claim 5 is now believed to be allowable as a result of the amendments to claim 4. The Applicant therefore respectfully requests that the Examiner reconsider and allow claims 4 and 5 as amended herein above.

If any further amendment to this application is believed necessary to advance prosecution and place this case in allowable form, the Examiner is courteously solicited to contact the undersigned representative of the Applicant to discuss the same.

In view of the above amendments and remarks, it is respectfully submitted that all of the raised rejection(s) should be withdrawn at this time. If the Examiner disagrees with the Applicant's view concerning the withdrawal of the outstanding rejection(s) or applicability of the Hayashi `022, Hasegawa `928 and McCarrick et al. `053 references, the Applicant respectfully requests the Examiner to indicate the specific passage or passages, or the drawing or drawings, which contain the necessary teaching, suggestion and/or disclosure required by case law. As such teaching, suggestion and/or disclosure is not present in the applied references, the raised rejection should be withdrawn at this time. Alternatively, if the Examiner is relying on his/her expertise in this field, the Applicant respectfully requests the Examiner to enter an affidavit substantiating the Examiner's position so that suitable contradictory evidence can be entered in this case by the Applicant.

In view of the foregoing, it is respectfully submitted that the raised rejection(s) should be withdrawn and this application is now placed in a condition for allowance. Action to that end, in the form of an early Notice of Allowance, is courteously solicited by the Applicant at this time.

The Applicant respectfully requests that any outstanding objection(s) or requirement(s), as to the form of this application, be held in abeyance until allowable subject matter is indicated for this case.

In the event that there are any fee deficiencies or additional fees are payable, please charge the same or credit any overpayment to our Deposit Account (Account No. 04-0213).

Respectfully submitted,

Gary D. Clapp, Reg. No. 39,055
Customer No. 020210
Davis & Bujold, P.L.L.C.
Fourth Floor
500 North Commercial Street
Manchester NH 03101-1151
Telephone 603-624-9220
Facsimile 603-624-9229
E-mail: patent@davisandbujold.com